STO-2: Support for 4th Year Operations, Recovery, and Science JHU/APL Co-I

Completed Technology Project (2017 - 2017)

Project Introduction

This is a collaboration Co-I Institution proposal for the proposal "STO-2: Support for 4th Year Operations, Recovery, and Science" whose lead proposal is submitted by the University of Arizona with Dr. Christofer Walker as PI. STO-2 was flight-ready in the 2015-2016 austral summer. However, due to the late establishment of the stratospheric anti-cyclone and poor surface conditions, STO-2 was unable to launch. The decision was made to winter-over the STO-2 payload in its hangar for launch during the 2016-2017 Antarctic campaign. Funds to cover preparations and deployment of key members of the instrument team in support of the campaign are being provided by NASA under the existing grant. However, these funds are only sufficient to cover expenses up to approximately December 31st. Here we request supplemental funds to cover costs associated with STO-2 operations and recovery beyond this date. STO-2 will address a key problem in modern astrophysics, understanding the Life Cycle of the Interstellar Medium (ISM). STO-2 will survey approximately 1/4 of the Southern Galactic Plane in the dominant interstellar cooling line [CII] (158 μm) and the important star formation tracer [NII] (205 μm). In addition, STO-2 will perform path finding observations of the 63 μm [OI] line toward selected regions. With ~1 arcminute angular resolution, STO-2 will spatially resolve atomic, ionic and molecular clouds out to 10 kpc. The STO-2 survey will be conducted at unparalleled sensitivity levels. STO-2 will uniquely probe the pivotal formative and disruptive stages in the life cycle of interstellar clouds and the relationship between global star formation rates and the properties of the ISM. Combined with previous HI and CO surveys, STO-2 will create 3-dimensional maps of the structure, dynamics, turbulence, energy balance, and pressure of the Milky Way's ISM, as well as the star formation rate. Once we gain an understanding of the relationship between ISM properties and star formation in the Milky Way, we can better interpret observations of nearby galaxies and the distant universe. The mission goals for these surveys are to: 1) Determine the life cycle of Galactic interstellar gas. 2) Study the creation and disruption of star-forming clouds in the Galaxy. 3) Determine the parameters that affect the star formation rate in the galaxy. 4) Provide templates for star formation and stellar/interstellar feedback in other galaxies. STO-2 reuses the 80 cm telescope and many subsystems from STO-1. It also reuses the gondola developed by APL for the BOPPS and BRISSON comet missions. For the STO-2 flight, STO-1's high spectral resolution (<1 km/s) heterodyne receiver system was upgraded for extended cryogenic lifetime, enhanced sensitivity, and greater reliability. The flight receiver has five, cryogenic HEB mixers; two optimized for the 158 μm [CII] line, two for the 205 μm [NII] line, and one for the 63 μm [OI] line. STO is capable of detecting every giant molecular cloud, every HII region of significance, and every diffuse HI cloud with (AV >= 0.4) within its survey region.

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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

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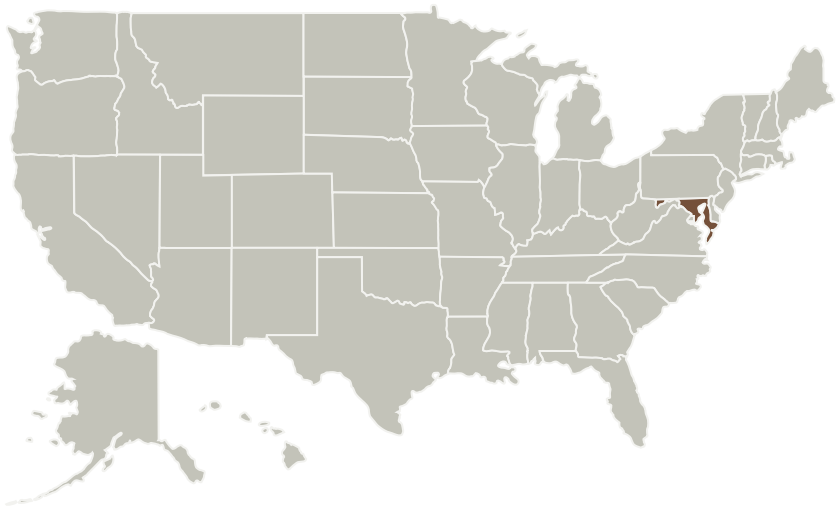
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Johns Hopkins University	Supporting Organization	Academia	Baltimore, Maryland

Primary U.S. Work Locations
Maryland

Project Management

Program Director:
Michael A Garcia

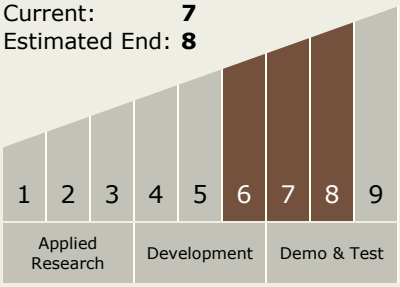
Program Manager:
Dominic J Benford

Principal Investigator:
Pietro N Bernasconi

Co-Investigators:
Felicia Hastings
Harry Eaton
Katherine A Stambaugh

Technology Maturity (TRL)

Start: **6**
Current: **7**
Estimated End: **8**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.3 Distributed Aperture

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Target Destination

Outside the Solar System